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Student Notes
Science on Saturday
Lawrence Livermore National Laboratory

February 1, 2014

Computer Simulation: *Exploring Nature with a Computer*

Vic Castillo, LLNL; Rodger Johnson, Monte Vista High School

Students will learn about computer modeling and simulation, will understand what modeling and simulation are, and why it is increasingly used in all areas of scientific research. In addition, students will be presented with ways in which scientists at Lawrence Livermore Laboratory in particular use simulations and modeling. Finally, students will be introduced to freeware that will allow them to create their own models for school projects or personal interest.

Today You Will Learn:
What is computer modeling and simulation?
Why do we use this important tool?
How is it used at LLNL?
How you can start!

1. What are three key parts of computer models?
   a.
   b.
   c.

2. What are the two traditional parts to areas of scientific study?

3. How does computer modeling fit in with those two parts?

4. What are two advantages to computer models compared to traditional pencil and paper calculations?

5. What changes are occurring with computers and computing that have made computational modeling easier?

6. What is Moore's Law, and how is it important to computer modeling?

7. Some of the fastest computers in the world are found at:

8. Name at least three areas of research at Livermore Lab where modeling and simulation are used:
    1.
    2.
    3.

9. What is the name of the freeware that you can use to start to build computer models at home or in the classroom?

10. What are some advantages of this software?
    1.
    2.
    3.
    4.

11. Give an example of how students have already built computer models.

12. What is the name of the student robot that is being tested with computer models?

    a) GoBot
    b) MegaBot
    c) XBot
    d) TurtleBot

Vic Castillo is a research engineer at the Lawrence Livermore National Laboratory and uses computer simulation as a powerful tool. Projects that he has worked on include simulation of turbulent fluids, hypersonic flows, neural networks, enterprise dynamics, and additive manufacturing (aka 3D printing). Vic does a lot of STEM outreach including mentoring robotics teams, teaching simulation courses, and developing educational materials.

Rodger Johnson teaches physics and chemistry at Monte Vista High School. Rodger graduated from UC Berkeley with a BA in English and then studied physical sciences at CSU East Bay. He has been teaching physics and chemistry in the east bay for more than 20 years. His first computer was a Commodore and over the years he has programmed in BASIC, Pascal, C, C++, and Java as well as NetLogo. His current interests include using microcontrollers with mechanical sculptures and trying to find uses for his Raspberry Pi.